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**Declarations under Rule 4.17:**

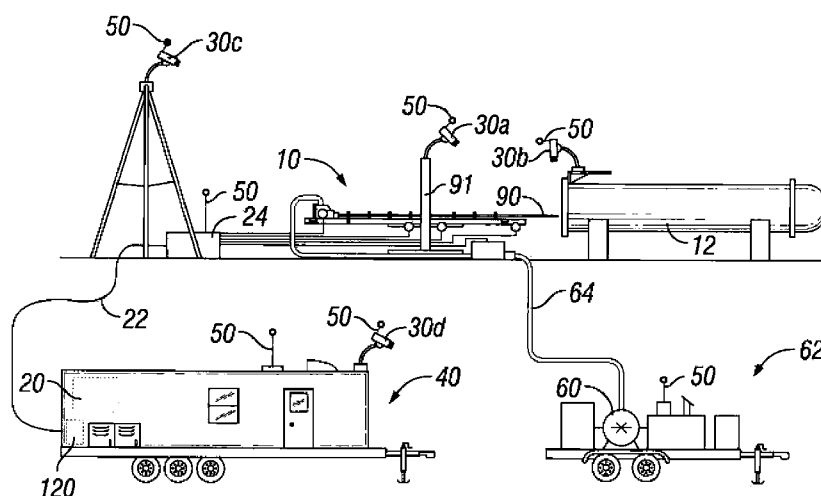
- as to the identity of the inventor (Rule 4.17(i))
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

**Published:**

- with international search report (Art. 21(3))

[Continued on next page]

(54) Title: AUTOMATED HEAT EXCHANGER TUBE CLEANING ASSEMBLY AND SYSTEM



**FIG. 1**

(57) Abstract: An automated heat exchanger tube cleaning assembly and system are provided. The present system can automatically (without ongoing human intervention) survey the tube sheet of a heat exchanger in three-dimensions, convert and record the survey results as a digital file in three-dimensions, and then, according to sequential parameters input via custom software, automatically coordinate via computer one or more cleaning devices to effect the cleaning of each desired tube of the heat exchanger.

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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

**(88) Date of publication of the international search report:**  
30 June 2011

# INTERNATIONAL SEARCH REPORT

International application No PCT/US2009/001764
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**A. CLASSIFICATION OF SUBJECT MATTER**  
 INV. F28G15/00  
 ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
 F28G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 681 839 B1 (BALZER BRENT A [US]) 27 January 2004 (2004-01-27) abstract column 5, line 12 - column 7, line 27; figure 12	1-9
X	-----	
X	US 2004/006841 A1 (JAMEEL MOHOMED ISHAG [US] ET AL) 15 January 2004 (2004-01-15) abstract paragraph [0081]	1-9
X	-----	
X	US 5 065 703 A (LEE ROBERT A S [US]) 19 November 1991 (1991-11-19) figure 19	1-9
A	-----	
A	EP 0 162 309 A2 (SCHMUTZ GMBH ERNST [DE]) 27 November 1985 (1985-11-27) abstract	1-9
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Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

15 February 2011

Date of mailing of the international search report

11/05/2011

Name and mailing address of the ISA/

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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2009/001764

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
  
2.  As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
  
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

See additional sheet(s)

### Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2009/001764

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6681839	B1	27-01-2004	NONE
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US 2004006841	A1	15-01-2004	NONE
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US 5065703	A	19-11-1991	NONE
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EP 0162309	A2	27-11-1985	CA 1253848 A1 09-05-1989
		DE 3418835 A1 21-11-1985	
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		JP 60253797 A 14-12-1985	
		US 4691723 A 08-09-1987	
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**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-9

A system for cleaning one or more tubes in a heat exchanger with a specific surface scanning device.

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2. claims: 10-13

A method of cleaning one or more tubes in a heat exchanger by capturing an image of the heat exchanger tube sheet.

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3. claims: 14-21

A system for cleaning one or more tubes in a heat exchanger with a specific display for presenting a map of at least a portion of the tube sheet and a user input device.

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4. claims: 22, 23, 26-28

A method of maneuvering a heat exchanger cleaning device with respect to a tube sheet by accepting user input regarding reference points defining the location of the tubes to be cleaned (claims 22, 23); a method of cleaning a tube on the tube sheet of a heat exchanger by accepting user input regarding reference points defining the location of the tubes to be cleaned (claims 26 to 28).

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5. claims: 24, 25, 29, 30

A method of maneuvering a heat exchanger cleaning device with respect to a tube sheet by accepting user input regarding reference points defining the perimeter of a cleaning region with one or more tubes (claims 24, 25); a method of cleaning a tube on the tube sheet of a heat exchanger by accepting user input regarding reference points defining the perimeter of a cleaning region with one or more tubes (claims 29 and 30).

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6. claims: 31-34

An apparatus for cleaning one or more tubes on the tube sheet of a heat exchanger with a rotating tube cleaning lance.

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